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with which they are associated possessed a practical knowledge of scientific work and methods. Without such experience the executive is at the mercy of every assertive paradoxer and can not discriminate between impracticable devices and the judgment of science upon them. While, therefore, the country has at its disposal the work—either voluntary or nearly so—of experts in all branches of applied science, it can not use these services to the best advantage unless the departments concerned with them have scientific men among the permanent officials; and that is not the case at present.

The unbusinesslike methods of government departments have received severe criticism lately, but nothing has been said about the unscientific method of appointing committees of experts without well-qualified officers to direct or coordinate their work. The reason is that, with scarcely an exception, no daily paper has any one on its staff possessing the most elementary knowledge of the meaning of scientific research. Our guides and counselors, both on the political platform and in the periodical press, can scarcely be expected to interest themselves greatly in subjects beyond their mental horizon, so when scientific matters are involved they confine themselves to a few platitudes, or say nothing at all. They are unable to distinguish a quack from a leading authority in science, and prefer to exercise their imaginations upon sensational announcements, rather than discuss the possibilities of sober scientific discovery. In all that relates to the interests of science—and that means in the end the interests of the nation—the men who influence public opinion and control the public services are mostly unenlightened and therefore unsympathetic.

The tacit assumption that public committees or departments concerned with scientific problems must have at their head officers of the army, navy, or civil service is responsible for delay in taking advantage of available expert knowledge and for the neglect to make effective use of science in national affairs, whether in times of war or peace. Just as a member of the government may serve in turn

as president of the Board of Education, Board of Agriculture, Board of Trade, or any other department, without possessing any special qualifications to comprehend the work of either, so a public official may be placed in a position to dominate activities of which he can not understand the significance. Some day we hope that this mad system will be swept away, and that the men who exert control in all government offices will be those whose training or experience make them most capable of doing so effectively.—*Nature*.

SCIENTIFIC BOOKS

A Budget of Paradoxes. By AUGUSTUS DE MORGAN. Reprinted, with the author's additions, from the *Athenæum*. Second edition edited by DAVID EUGENE SMITH. Two volumes, I., viii + 402 pp.; II., 387 pp. The Open Court Publishing Co., 1915. Price \$3.50 per volume.

The similarity between the work of David Eugene Smith and Augustus De Morgan in the field of popularizing mathematics has long been familiar to students of the history of science. This similarity has extended to many details; both men have participated in the publication of elementary text-books of excellence, both are known as editors of the mathematical department of encyclopedias and dictionaries, both have been energetic collectors of mathematical books and other mathematical material, and both have been distinguished by a wide and human interest in all phases of mathematical development. Hence it is eminently fitting that as editor of this new edition of "A Budget of Paradoxes" we should have Professor Smith, who not long ago continued so ably in the "Rara Arithmetica," De Morgan's bibliographical work, represented by "Arithmetical Books from the Invention of Printing to the Present Time" (London, 1847).

The first question which occurs to the casual reader whose eye catches the title is regarding the significance of the word "paradox." De Morgan answers this [I., 2] in a manner that even to-day has meaning for many who publish books. "A great many individuals, ever since

the rise of the mathematical method, have, each for himself, attacked its direct and indirect consequences. I shall not here stop to point out how the very accuracy of exact science gives better aim than the preceding state of things could give. I shall call each of these persons a *paradoxe*, and his system a *paradox*. I use the word in the old sense: a paradox is something which is apart from general opinion, either in subject-matter, method or conclusion." Further on in his introductory remarks De Morgan adds: "After looking into books of paradoxes for more than thirty years, and holding conversation with many persons who have written them, and many who might have done so, there is one point on which my mind is fully made up. The manner in which a paradoxer will show himself, as to sense or nonsense, will not depend upon what he maintains, but upon whether he has or has not made a sufficient knowledge of what has been done by others, *especially as to the mode of doing it*, a preliminary to inventing knowledge for himself. That a little knowledge is a dangerous thing is one of the most fallacious of proverbs. A person of small knowledge is in danger of trying to make his *little* do the work of *more*; but a person without any is in more danger of making his *no* knowledge do the work of *some*."

How De Morgan would have enjoyed for his collection the solution (?) of Fermat's problem by Miss ———, of the New York schools, whose name will not go down in history, published by the staidest of New York evening papers; this problem to solve, or prove not solvable, $x^n + y^n = z^n$ in integers for n greater than 2 has been the subject of many similar solutions and the Wolfskehl prize of \$25,000 has often been claimed and as often denied. Without fear of contradiction we may say that the final solution will be given by some able student of number theory who is not ignorant of "what has been done by others." Equally would De Morgan have welcomed the high-school boy's solution (?) of the trisection of an angle, with ruler and compass, published only three or four years ago in a journal devoted to elementary science. Particularly, too, De Morgan would have desired for his "Budget"

something typical concerning our American prodigies, whose names, we note, are found more often in paragraphs than in monographs, more often in headlines than in footnotes.

How many works of to-day come within the classification of paradoxical nonsense, foisted upon the press by authors ignorant of "what has been done by others" in the fields in which these authors would instruct the public. Among these "paradoxers" are scientists of real fame in science, but without philosophy, who wish to instruct philosophers in philosophy, philosophers ignorant of the work of Georg Cantor and Dedekind who wish to instruct mathematicians about the nature of the number idea and the psychology of number, school superintendents who are profoundly ignorant of the fundamental ideas of arithmetic who wish to write text-books on arithmetic, old maids living in a two-room flat on the fifteenth floor of a New York apartment who wish to instruct the parents of the United States on the art of bringing up a large family of children, manufacturers successful in business who yearn to instruct the world in philosophy and science. These are modern *paradoxers* of the nonsense type who need another De Morgan to call attention to their folly.

"All the men who are now called discoverers, in every matter ruled by thought, have been men versed in the minds of their predecessors, and learned in what had been before them. There is not one exception. I do not say that every man has made direct acquaintance with the whole of his mental ancestry; many have, as I say, only known their grandfathers by the report of their fathers. But even on this point it is remarkable how many of the greatest names in all departments of knowledge have been real antiquaries in their several subjects.

"... if any one will undertake to show a person of little or no knowledge who has established himself in a great matter of pure thought, let him bring forward his man and we shall see."

Let every editor have a copy of these words to enclose with rejected manuscripts which violate the principles so sanely laid down by De Morgan.

Mathematical paradoxes are largely connected with the squaring of the circle, the ratio π , the duplication of the cube, the trisection of the angle, and the number of the beast; astronomical paradoxes are quite as frequent, here, as the mathematical; religion, philosophy and medicine, too, enter in for a goodly share of attention. De Morgan had a very live interest in the history of science, and this interest finds frequent expression in the "Budget."

Not all the material, by any means, of these interesting volumes is concerned with paradoxes of the *nonsense* type. Le Verrier's planet Neptune is presented with certain original documents connected with the discovery; the names of Herschel, royal astronomer, and Brünnow, who was later director of the observatory at the University of Michigan, and Challis of the Cambridge Observatory are indications of a paradox, "something contrary to the current opinion" which was really revolutionary. Historical material appears with relative frequency, giving pleasant intervals of relief from regarding the errors of mankind.

Of particular interest are those notes which De Morgan inserts about men and affairs of his own time. The liberal footnotes added largely by Professor Smith, and occasionally by De Morgan's wife or from De Morgan's notes, contribute much to the modern reader's pleasure in perusing the volumes.

The "Budget," it need hardly be stated, was not intended to be read as a romance, although much of the material suggests that artistic rambling which is so delightfully characteristic of William De Morgan, the son of our mathematician Augustus De Morgan. Rather these are volumes to be read at odd moments, and always one will find profitable enjoyment. In spite of the interest and amusement with which we thumb the pages a feeling of sadness for the human frailty comes over the reader. De Morgan expresses this sentiment, too, in the brief but pointed comment on the work of an angle-trisector. After giving the title of the work De Morgan continues with a quotation of words from the author of the trisection, followed by five words of comment: "'The con-

sequence of years of intense thought': very likely, and very sad."

The physical make-up of this edition is up to the high standard which has been set by other publications of the Open Court Company. In every way the reader who takes these volumes in hand has pleasure in store; we commend the works to all who take a kindly interest not only in the greatness but equally in the frailty of their fellows.

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Scottish National Antarctic Expedition. Report on the Scientific Results of the Voyage of the Scotia, during the Years 1902-4. Vol. IV., Zoology. Parts II.-XX., Vertebrates. Edinburgh, 1915. Pp. 505. 4to. 62 pl. 31 text-figures and 2 maps.

Before the voyage of the *Scotia* under the leadership of Dr. Wm. S. Bruce there had not been a deep-sea sounding taken south of S. Latitude 40° in the Atlantic Ocean. The uninviting lands of the South Orkneys, the South Shetlands and South Georgia, were rarely visited and relatively little known. As a direct result of the Swedish and Scottish expeditions in the Weddell Sea an extensive whale fishery has been developed having its headquarters at Leith. Now according to Dr. Bruce over a thousand people live in South Georgia, and during the summer months the South Orkneys and South Shetlands are a hive of industry, and altogether over five million dollars gross annual revenue is now taken in those regions previously regarded as worthless by business men.

Owing to the struggle in which the country is engaged, money for the publication of the scientific results could no longer be supplied by the treasury; and several of the reports were consequently issued in scientific periodicals, such as the *Ibis* and the *Proceedings of the Royal Physical Society*; but by the generosity of Sir Thomas Coats, the collaboration of the Scottish Oceanographical Society, the Carnegie Trust, the Royal Societies of Edinburgh and London and other friends and organizations, these and other papers are brought together in